What is claimed is:

1. A method of upregulating telomerase expression in a eukaryotic cell, tissue, or organ, comprising contacting the eukaryotic cell, tissue, or organ with a peptide compound having the formula:

R_1 Gln Tyr Lys Leu Gly Ser Lys Thr Gly Pro Gly Gln R_2 (SEQ ID NO:1),

wherein R_1 is absent or is an amino terminal capping group and R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

2. A method of upregulating telomerase expression in a eukaryotic cell, tissue, or organ, comprising contacting the eukaryotic cell, tissue, or organ with a peptide compound having the formula:

R_1 Gln Thr Leu Gln Phe Arg R_2 (SEQ ID NO:2),

wherein R_1 is absent or is an amino terminal capping group and R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

3. A method of upregulating telomerase expression in a eukaryotic cell, tissue, or organ, comprising contacting the eukaryotic cell, tissue, or organ with a peptide compound having the formula:

R_1 Xaa_1 Gly Xaa_3 Xaa_4 Xaa_5 Xaa_6 Xaa_7 R_2 (SEQ ID NO:3),

wherein Xaa_1 and Xaa_3 are, independently, aspartic acid or asparagine; R_1 is absent or is an amino terminal capping group of the peptide compound; Xaa_4 is absent or Gly; Xaa_5 is absent, Asp, or Phe; Xaa_6 is absent, Ala, or Phe; Xaa_7 is absent or Ala; R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

4. The method according to Claim 3, wherein the peptide compound is selected from the group consisting of:

Asp Gly Asp,

Asp Gly Asn,
Asn Gly Asn,
Asn Gly Asp,
Asp Gly Asp Gly Asp (SEQ ID NO:4),
Asp Gly Asp Gly Phe Ala (SEQ ID NO:5),
Asp Gly Asp Gly Asp Phe Ala (SEQ ID NO:6),
Asp Gly Asn Gly Asp Phe Ala (SEQ ID NO:7),
Asn Gly Asn Gly Asp Phe Ala (SEQ ID NO:8), and
Asn Gly Asp Gly Asp Phe Ala (SEQ ID NO:9),

wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

5. A method of upregulating telomerase expression in a eukaryotic cell, tissue, or organ, comprising contacting the eukaryotic cell, tissue, or organ with a peptide compound having the formula:

R_1 Asn Ser Thr R_2,

wherein R_1 is absent or is an amino terminal capping group; R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

6. A method of upregulating telomerase expression in a eukaryotic cell, tissue, or organ, comprising contacting the eukaryotic cell, tissue, or organ with a peptide compound having the formula:

R_1 Phe Asp Gln R_2,

wherein R_1 is absent or is an amino terminal capping group; R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

7. A method of upregulating telomerase expression in a eukaryotic cell, tissue, or organ, comprising contacting the eukaryotic cell, tissue, or organ with a peptide compound having the formula:

R_1 Xaa_1 Xaa_2 Met Thr Leu Thr Gln Pro R_2 (SEQ ID NO:10),

wherein Xaa_1 is absent or Ser; Xaa_2 is absent or Lys; R_1 is absent or is an amino terminal capping group; R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

8. The method according to Claim 7, wherein the peptide compound is selected from the group consisting of:

Met Thr Leu Thr Gln Pro (SEQ ID NO:11) and

Ser Lys Met Thr Leu Thr Gln Pro (SEQ ID NO:12),

wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

9. A method of upregulating telomerase expression in a eukaryotic cell, tissue, or organ, comprising contacting the eukaryotic cell, tissue, or organ with a peptide compound having the formula:

R_1 Asp Gly Xaa_3 Xaa_4 Xaa_5 R_2 (SEQ ID NO:13),

wherein R_1 is absent or is an amino terminal capping group; Xaa_3 is Glu or Leu; Xaa_4 is Ala or Glu; Xaa_5 is absent, Leu, or Ala; and R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

10. The method according to Claim 9, wherein said peptide compound is selected from the group consisting of:

R_1 Asp Gly Glu Ala R_2 (SEQ ID NO:14),

R_1 Asp Gly Glu Ala Leu R_2 (SEQ ID NO:16), and

R_1 Asp Gly Leu Glu Ala R_2 (SEQ ID NO:17),

wherein R_1 is absent or is an amino terminal capping group of the peptide compound and R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

11. The method according to Claim 10, wherein said peptide compound is:

[Ac] Asp Gly Glu Ala (SEQ ID NO:14),

wherein [Ac] is an acetyl amino terminal capping group; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

12. A method of upregulating telomerase expression in a eukaryotic cell, tissue, or organ, comprising contacting the eukaryotic cell, tissue, or organ with a peptide compound having the formula:

R_1 Xaa_1 Xaa_2 Asp Gly Xaa_5 Xaa_6 Xaa_7 Xaa_8 Xaa_9 Xaa_{10} Xaa_{11} R_2 (SEQ ID NO:15),

wherein R_1 is absent or is an amino terminal capping group; Xaa_1 is absent or any amino acid; Xaa_2 is absent or any amino acid; Xaa_5 is Glu or Leu; Xaa_6 is Ala or Glu; Xaa_7 is absent, Leu, or Ala; Xaa_8 is absent or is any amino acid; Xaa_9 is absent or is any amino acid; Xaa_{10} is absent or is any amino acid; Xaa_{11} is absent or is any amino acid; and R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

13. A method of upregulating telomerase expression in a eukaryotic cell, tissue, or organ, comprising contacting the eukaryotic cell, tissue, or organ with a peptide compound having the formula:

R_1 Xaa_1 Xaa_2 Xaa_3 R_2,

wherein Xaa_1 is Asp, Asn, Glu, Gln, Thr, or Tyr; Xaa_2 is absent or any amino acid; Xaa_3 is absent or is Glu, Thr, Ser, Gly, or Leu; R_1 is absent or is an amino terminal capping group and R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

14. The method according to Claim 13, wherein Xaa_2 is selected from the group consisting of Val, Gly, Glu, and Gln.

15. The method according to Claim 13, wherein the peptide compound is selected from the group consisting of:

R_1 Asp Gly R_2, R_1 Asn Gly R_2, R_1 Glu Gly R_2, R_1 Gln Gly R_2, and R_1 Thr Val Ser R_2, wherein R_1 is absent or is an amino terminal capping group and R_2 is absent or is a carboxy terminal capping group of the peptide compound.

16. The method according to Claim 15, wherein the peptide compound has the formula:

R_1 Asp Gly,

wherein R_1 is a thyronine group.

17. The method according to Claim 16, wherein the thyronine group is selected from the group consisting of a thyronine group having no iodine substitutions, a monoiodothyronine, a diiodothyronine, a triiodothyronine, and a tetraiodothyronine.

18. The method according to Claim 17, wherein the thyronine group is triiodothyronine.

19. The method according to Claim 18, wherein the triiodothyronine is 3,5,3'-triiodothyronine.

20. A method of upregulating telomerase expression in a eukaryotic cell, tissue, or organ, comprising contacting the eukaryotic cell, tissue, or organ with a peptide compound having the formula:

R_1 Leu Xaa_2 Xaa_3 R_2,

wherein Xaa_2 is any amino acid; Xaa_3 is Gln or Tyr; R_1 is absent or is an amino terminal capping group; R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cells, tissue, or organ.

21. A method of upregulating telomerase expression in a eukaryotic cell, tissue, or organ, comprising contacting the eukaryotic cell, tissue, or organ with a peptide compound having the formula:

R_1 Met Thr Xaa_3 R_2,

wherein Xaa_3 is Asn, Asp, Glu, Thr, or Leu; R_1 is absent or is an amino terminal capping group; R_2 is absent or is a carboxy terminal capping group of the peptide compound; and wherein the peptide compound is present in an amount effective to upregulate expression of telomerase in the eukaryotic cell, tissue, or organ.

22. The method according to any one of Claims 1, 2, 3, 5, 6, 7, 9, 10, 12, 13, 20, and 21, wherein the R_1 amino terminal capping group is selected from the group consisting of a lipoic acid moiety (Lip); a glucose-3-O-glycolic acid moiety (Gga); 1 to 6 lysine residues; 1 to 6 arginine residues; a combination of 2 to 6 lysine and arginine residues; a thyronine group; an acyl group of the formula R_3-CO-, where CO is a carbonyl group and R_3 is a hydrocarbon chain having from 1 to 25 carbon atoms; and combinations thereof.

23. The method according to Claim 22, wherein the amino terminal capping group is an acyl group of the formula R_3-CO-, where CO is a carbonyl group and R_3 is a hydrocarbon chain having from 1 to 22 hydrocarbons and wherein the hydrocarbon chain is a saturated, unsaturated, branched, or unbranched hydrocarbon chain.

24. The method according to Claim 22, wherein the amino terminal capping group is an acyl group.

25. The method according to Claim 24, wherein the acyl group is a fatty acyl group.

26. The method according to Claim 24 wherein the acyl group is selected from the group consisting of: acetyl, palmitoyl (Palm), and docosahexaenoly (DHA).

27. The method according to Claim 22, wherein the thyronine group is selected from the group consisting of a thyronine having no iodine substitutions, a monoiodothyronine, a diiodothyronine, a triiodothyronine, and a tetraiodothyronine.

28. The method according to Claim 27, wherein the thyronine group is triiodothyronine.

29. The method according to Claim 28, wherein the triiodothyronine is a 3,5,3'-triiodothyronine.

30. The method according to any one of Claims 1, 2, 3, 5, 6, 7, 9, 10, 12, 13, 20, and 21, wherein the R_2 carboxy terminal capping group is a primary or secondary amine.

31. The method according to any one of Claims 1, 2, 3, 5, 6, 7, 9, 10, 12, 13, 20, and 21, wherein the peptide compound is provided in a composition for administration to a eukaryotic organism through a route selected from the group consisting of an oral route, an intravenous route, an intra-arterial route, an intramuscular route, and a subcutaneous route.